NMR-based GFR Estimating Equation in Kidney Transplant Recipients Bias and Precision

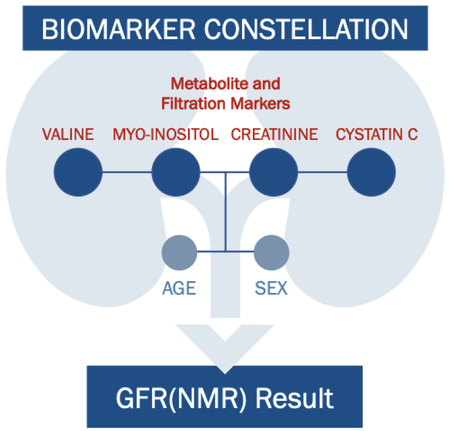
Amauri Schwäble Santamaría[1], Jeffrey Meeusen[2], Marcello Grassi[1], Andrew Robertson[1], Eric Schiffer[1]

[1]Numares AG, Regensburg, Germany. [2]Mayo Clinic, Rochester, MN, United States.

BACKGROUND

Accurate and reliable measurement of glomerular filtration rate (GFR) in the post-kidney transplant phase is paramount to monitor for rejection and disease progression. The current gold-standard tracer, measured GFR (mGFR), is poorly available at most centers and heavily time-consuming. New estimated GFR (eGFR) methods containing cystatin C are yet to be validated in this cohort. We evaluate a new NMR-based GFR equation (Fig. 1), using creatinine, cystatin C, myoinositol and valine, in post-kidney transplant recipients.

Figure 1. GFR(NMR) Constellation



METHODS

In 67 post-kidney transplant recipients, eGFR was assessed using the following equations: 1) GFR(NMR) (*AXINON*®, Numares AG, Regensburg, Germany), 2) CKD-EPI2021 Cr, and 3) CKD-EPI2021 Cr,Cys. Bias was calculated as 'eGFR minus urinary iothalamate clearance (mGFR)' for all the equations and pairwise significance levels between bias distributions interquartile ranges (IQR) were assessed via bootstrap method with p-value correction using the Benjamini & Hochberg method for false discovery rate. Precision, which was defined as percentage of samples within ±30% and ±15% from the mGFR values (P_{30} and P_{15}, respectively), was calculated for each equation also, and pairwise comparisons were made using McNemar's Chi-squared test for count data with p-value correction using the Benjamini & Hochberg method for false discovery rate. Precision was defined as the proportion of eGFR concordant with mGFR CKD clinical categories.

RESULTS

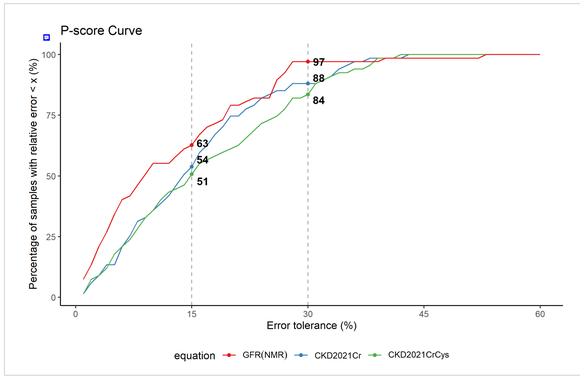
P_{30} for GFR(NMR) was 97%; significantly higher than CKD-EPI2021 Cr,Cys (84%, p<0.01) and higher than CKD-EPI2021 Cr (88%, p=0.077) (Table 1, Fig. 2). Regarding P_{15} value, GFR(NMR) was 63%; higher than CKD-EPI2021 Cr (54%, p<0.345) and CKD-EPI2021 Cr,Cys (51%, p<0.186).

RESULTS (CONT.)

Table 1. p-Score Values at P_{15} and P_{30}

p	Measure 1	Measure 2	p Measure 1 (%)	p Measure 2 (%)	p-value
p15	GFR (NMR)	CKD-EPI2021 Cr	63	54	0.345
		CKD-EPI2021 Cr,Cys		51	0.186
p30	GFR (NMR)	CKD-EPI2021 Cr	97	88	0.077
		CKD-EPI2021 Cr,Cys		84	**0.008**

Figure 2. Precision, P-score Curve



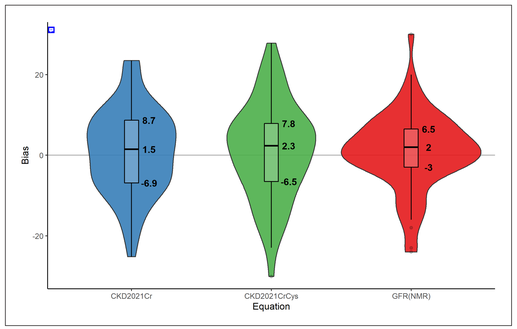
Bias IQR for the GFR(NMR) equation was 9.5 mL/min/1.73m² (median bias 2 mL/min/1.73m²); significantly smaller than CKD-EPI2021 Cr (Bias IQR 15.55 mL/min/1.73m², p<0.05; median bias 1.47 mL/min/1.73m²), and smaller than CKD-EPI2021 Cr,Cys (Bias IQR 14.36 mL/min/1.73m², p=0.088; median bias 2.34 mL/min/1.73m²). (Table 2, Fig. 3)

RESULTS (CONT.)

Table 2. Bias IQR and Median Values

Measure 1	Measure 2	IQR [median] Measure 1 (mL/min/1.73m²)	IQR [median] Measure 2 (mL/min/1.73m²)	p-value
GFR (NMR)	CKD-EPI2021 Cr	9.5 [2]	15.55 [1.47]	**0.026**
	CKD-EPI2021 Cr,Cys		14.36 [2.34]	0.088

Figure 3. Bias Distribution



CONCLUSION

NMR-based eGFR was less biased, more precise and more accurate compared to creatinine and cystatin C CKD-EPI eGFR equations in a clinical routine setting. These findings suggest GFR(NMR) may more closely resemble mGFR results in post-transplant patients and warrant further study on potential use for improved clinical management.

**AXINON® GFR(NMR)* assay is for research use only and is not cleared or approved for diagnostic test procedures.

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